

CLAIMS

What is claimed is:

1. A gas separation apparatus comprising:
 - an irradiation chamber for receiving a gas;
 - 5 an irradiation device for irradiating the gas within the irradiation chamber for causing molecules of the gas to break apart into larger and smaller constituent components;
 - a separation arrangement for separating the larger and smaller constituent components from each other within the irradiation chamber by forcing the larger and smaller constituent components toward different regions of the irradiation chamber; and
 - 10 a first outlet for removing the smaller constituent components from the irradiation chamber.
2. The apparatus of Claim 1 further comprising a second outlet for removing the
15 larger constituent components from the irradiation chamber.
3. The apparatus of Claim 2 in which the irradiation device is an electron beam device for irradiating the gas with an electron beam.
4. The apparatus of Claim 3 in which the separation arrangement includes a rotary member capable of rotating about an axis, rotation of the rotary member for
20 causing the larger constituent components to move radially outwardly relative to the axis of the rotary member and the smaller constituent components.

5. The apparatus of Claim 3 in which the separation arrangement includes a waveform generator for separating the smaller constituent components from the larger constituent components.
6. The apparatus of Claim 1 in which the smaller constituent components comprise H⁺ ions, the apparatus further comprising a reaction chamber in communication with the first outlet for reacting the H⁺ ions with oxygen.
7. The apparatus of Claim 6 further comprising an electrical connection between the irradiation chamber and the reaction chamber for conveying electrons from the irradiation chamber to the reaction chamber.
8. The apparatus of Claim 7 further comprising an electrical device electrically connected to said electrical connection and driven by said electrons.
9. The apparatus of Claim 1 further comprising a proton conducting device for extracting protons from the irradiation chamber.
10. A gas separation apparatus comprising:
 - an irradiation chamber for receiving a gas, the irradiation chamber including a rotary member capable of rotating about an axis;
 - an irradiation device for irradiating the gas within the irradiation chamber for causing molecules of the gas to break apart into larger and smaller constituent components, rotation of the rotary member for causing the larger constituent components to move radially outwardly relative to the axis of the rotary member and the smaller constituent components; and
 - a first outlet positioned near the axis of the rotary member for removing the smaller constituent components.

11. The apparatus of Claim 10 further comprising a second outlet positioned radially outwardly from the rotary member for removing the larger constituent components.
12. The apparatus of Claim 11 in which the irradiation device is an electron beam device for irradiating the gas with an electron beam.
13. The apparatus of Claim 12 further comprising a first collection unit connected to the first outlet for collecting the smaller constituent components.
14. The apparatus of Claim 13 further comprising a second collection unit connected to the second outlet for collecting the larger constituent components.
15. The apparatus of Claim 14 further comprising a recirculating passageway for recirculating some components back into the irradiation chamber.
16. The apparatus Claim 15 further comprising a recirculating pump for recirculating said components.
17. The apparatus of Claim 10 further comprising a gas source connected to the reaction chamber by an inlet passageway.
18. The apparatus of Claim 10 in which the rotary member includes a series of radially extending partitions.
19. A gas separation apparatus comprising:
 - an irradiation chamber for receiving a gas;
 - an irradiation device for irradiating the gas within the irradiation chamber for causing molecules of the gas to break apart into larger and smaller constituent components;

-23-

a waveform generator for separating the larger and smaller constituent components from each other; and

a first outlet for removing the smaller constituent components.

20. The apparatus of Claim 19 further comprising a second outlet for removing the
5 larger constituent components.
21. The apparatus of Claim 20 in which the irradiation device is an electron beam device for irradiating the gas with an electron beam.
22. The apparatus of Claim 19 in which the waveform generator provides a cyclic bi-directional time variant electric field.
- 10 23. The apparatus of Claim 22 in which the cyclic bi-directional time variant electric field extends between first and second regions.
24. A method of separating a gas comprising:
introducing the gas into an irradiation chamber;
irradiating the gas within the irradiation chamber with an irradiation
15 device for causing molecules of the gas to break apart into larger and smaller constituent components;
separating the larger and smaller first constituent components from each other within the irradiation chamber with a separation arrangement that forces the larger and smaller constituent components toward different regions of the
20 irradiation chamber; and
removing the smaller constituent components from the irradiation chamber through a first outlet.
25. The method of Claim 24 further comprising removing the larger constituent components from the irradiation chamber through a second outlet.

26. The method of Claim 25 in which the irradiation device is an electron beam device, the method further comprising irradiating the gas with an electron beam from the electron beam device.
27. The method of Claim 27 in which the separation arrangement includes a rotary member capable of rotating about an axis, the method further comprising rotating the rotary member for causing the larger constituent components to move radially outwardly relative to the axis of the rotary member and the smaller constituent components.
28. The method of Claim 26 in which the separation arrangement includes a waveform generator, the method further comprising separating the smaller constituent components from the larger constituent components with the waveform generator.
29. The method of Claim 24 in which the smaller constituent components comprise H^+ ions, the method further comprising reacting the H^+ ions with oxygen in a reaction chamber in communication with the first outlet.
30. The method of Claim 29 further comprising conveying electrons from the irradiation chamber to the reaction chamber with an electrical connection therebetween.
31. The method of Claim 30 further comprising driving an electrical device electrically connected to said electrical connection with said electrons.
32. The method of Claim 24 further comprising extracting protons from the irradiation chamber with a proton conducting device.

33. A method of separating a gas comprising:
introducing the gas into an irradiation chamber, in which the gas is
rotated about an axis;
irradiating the gas within the irradiation chamber with an irradiation
5 device for causing molecules of the gas to break apart into larger and smaller
constituent components, rotation of the constituent components causing the
larger constituent components to move radially outwardly relative to said axis
and the smaller constituent components; and
removing the smaller constituent components through a first outlet
10 positioned near said axis.
34. The method of Claim 33 further comprising removing the larger constituent
components through a second outlet positioned radially outwardly from said
axis.
35. The method of Claim 34 in which the irradiation device is an electron beam
15 device, the method further comprising irradiating the gas with an electron beam
from the electron beam device.
36. The method of Claim 35 further comprising collecting the smaller constituent
components in a first collection unit connected to the first outlet.
37. The method of Claim 36 further comprising collecting the larger constituent
20 components in a second collection unit connected to the second outlet.
38. The method of Claim 37 further comprising recirculating some components back
into the irradiation chamber with a recirculating passageway.
39. The method of Claim 38 further comprising recirculating said components with
a recirculating pump.

40. The method of Claim 33 further comprising connecting a gas source to the reaction chamber by an inlet passageway.
41. The method of Claim 33 further comprising forming the rotary member with a series of radially extending partitions for rotating the gas.
- 5 42. A method of separating a gas comprising:
introducing the gas into an irradiation chamber;
irradiating the gas within the irradiation chamber with an irradiation device for causing molecules of the gas to break apart into larger and smaller constituent components;
10 separating the larger and smaller constituent components from each other with a waveform generator; and
removing the smaller constituent components through a first outlet.
43. The method of Claim 42 further comprising removing the larger constituent components through a second outlet.
- 15 44. The method of Claim 43 in which the irradiation device is an electron beam device, the method further comprising irradiating the gas with an electron beam from the electron beam device.
45. The method of Claim 42 further comprising providing a cyclic bi-directional time variant electric field with the waveform generator.
- 20 46. The method of Claim 45 further comprising extending the cyclic bi-directional time variant electric field between first and second regions.